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Poly Met Mining, Inc. Antidegradation Analysis - Preliminary MPCA Determination

Primary: Scott Kyser

Secondary: Aida Mendez

Summary

Poly Met Mining, Inc. (PolyMet) submitted an NPDES/SDS application for a proposed new discharge. Every new discharge requires an antidegradation review. The purpose of an antidegradation review is to achieve and maintain the highest possible quality in surface water of the state (Minn. R. 7050.0250).

PolyMet has provided the Minnesota Pollution Control Agency (MPCA) with the necessary information in the permit application to satisfy antidegradation standards in Minn. R. 7050.0265. Submittal information demonstrates that water quality degradation caused by the proposed project will be prudently and feasibly minimized and that existing and beneficial uses will be protected. The application also demonstrates that the proposed activity is necessary to accommodate important economic or social changes in the geographic area in which degradation of existing high water quality is expected.

Applicable antidegradation standards and requirements are found in Minn. R. 7050.0250 to Minn. R. 7050.0335. Existing nondegradation standards in Minn. R. 7052.0300 to Minn. R. 7052.0330 for bioaccumulative chemicals of concern in the Lake Superior basin also apply. The full antidegradation analysis including tables, figures and appendices discussed in the write-up below can be found in appendix A of Volume III of the NPDES/SDS application <[HYPERLINK "https://www.pca.state.mn.us/sites/default/files/NPDES-SDS%20Permit%20App%20-%20Vol%20III%20-%20Waste%20Water%20Treatment%20System%20v1%20JUL2016.pdf"]>.

Background

The project's proposed discharge location is in the headwaters of Trimble Creek, Unnamed Creek (tributaries to the Embarrass River) and Second Creek (tributary to the Partridge River) in the St. Louis River watershed. The immediate receiving waters for the discharges in the Embarrass River watershed are wetlands that drain to Trimble and Unnamed Creeks which are class 2D, 3D, 4C, 5 and 6 waters. Trimble and Unnamed Creeks themselves are class 2B, 3C, 4A, 4B, 5 and 6 waters. The immediate receiving water for the discharge in the Partridge River watershed is Second Creek, which is a class 2B, 3C, 4A, 4B, 5 and 6 waters. All the above-identified waters are located in the Lake Superior basin and are classified as Outstanding International Resource Waters (OIRWs). The nearest downstream restricted Outstanding Resource Value Water (ORVW) is Lake Superior. There are no downstream prohibited ORVWs.

For the purposes of assuring protective antidegradation requirements, all downstream waters will be considered of high quality on a parameter-by-parameter basis. Minn. R. 7050.0255 subp. 21. This ensures that the antidegradation analysis provides "tier 2" protection. "Tier 2" protection prohibits the lowering of high water quality unless lower water quality resulting from the proposed activity is necessary to accommodate important economic or social changes in the geographic area in which degradation of existing high water quality is anticipated. The antidegradation analysis also considered "tier 3"protection for OIRWs and ORVWs. "Tier 3" protection requires the exceptional characteristics of

outstanding resource waters be maintained. MPCA's review included mercury, which is a bioaccumulative contaminant of concern (BCC) for the Lake Superior basin under 7052.0300.

The protective receiving water 7Q10 flow rate for all discharge locations is 0.0 CFS because of the headwaters nature of the site location. A 0.0 CFS receiving water flow rate does not allow for any assimilative dilution.

A prudent and feasible alternative that minimizes degradation has been identified

An analysis of alternatives that minimized net increases in loading of all relevant parameters of concern was performed, and an alternative that prudently and feasibly minimizes degradation was identified to manage all the parameters of concern. The parameters of concern are those parameters that have numeric water quality standards in Minn. R. 7050 and Minn. R. 7052 (including whole effluent toxicity standards). A summary of the alternative analysis process can be found in Sections 7.4 and 9.3 of the antidegradation analysis. PolyMet's antidegradation alternative analysis relies primarily on the alternatives evaluation included in the Final Environmental Impact Statement (FEIS). However, two new alternatives not included in the FEIS were considered: the potential for loading offsets and mercury management strategies in section 9.3. Loading offset alternatives are not possible because loading offsets must occur upstream of the discharge and the proposed discharges are to headwater waters. The alternatives evaluation considered a wide range of pollution minimization strategies ranging from pollution prevention to wastewater collection systems to advanced treatment plant design.

Nondegradation standards for the Lake Superior basin require analysis to identify cost-effective pollution prevention alternatives and techniques, and cost-effective alternative or enhanced treatment techniques, to eliminate or reduce the extent of increased loading of BCCs. Minn. R. 7052.0320, subp. 2. In addition to being a BCC, mercury is classified as a bioaccumulative substance of immediate concern. Minn. R. 7052.0350. Nondegradation review for bioaccumulative substances of immediate concern requires analysis of the Best Technology in Process and Treatment (BTPT). Minn. R. 7052.0320 subp. 3.

The design considerations and constraints, expected performance, and reliability of the least degrading alternative are described in the Waste Water Treatment System: Design and Operations Report for the NorthMet project <[HYPERLINK "https://www.pca.state.mn.us/sites/default/files/Waste%20Water%20Treatment%20System%20Design%20and%20Operation%20Report.pdf"]>. The expected performance of the system is based on a combination of engineering design, modeling, redundancy of critical treatment components and physical testing of the systems at the bench and pilot scale.

PolyMet has selected a combined water management and wastewater treatment system that will minimize or eliminate (i.e., to a level below method detection limit) pollutant loading to the receiving waters if the system performs as described in the permit application. The controlling design criterion is that the combined water management and treatment system consistently achieves a sulfate concentration of 10 mg/L or less in the effluent (Section 3.1.1). The degree of treatment necessary to accomplish an effluent concentration of 10 mg/L sulfate will also result in the effective removal of other parameters of concern from the wastewater. So long as sulfate remains at or below 10 mg/L, the proposed treatment system will ensure other parameters are discharged at concentrations described in the antidegradation analysis.

The design of the wastewater treatment system, which includes chemical precipitation and membrane treatment, will minimize or eliminate (i.e., to a level below method detection limits) the concentration of parameters of concern in the effluent. During bench and pilot testing of the membrane treatment system, PolyMet discovered that achieving a sulfate concentration of less than 10 mg/L in the effluent also resulted in the removal of other constituents in the wastewater such as metals and salty parameters (e.g., calcium, hardness and alkalinity) to very low levels. In fact, the level of treatment required to achieve a sulfate concentration in the effluent of 10 mg/L removes all parameters of concern to such a degree that stabilizing constituents essential for aquatic life, such as calcium and alkalinity, must be added back

to the internal waste stream as part of the treatment process to pass whole effluent toxicity (WET) testing requirements. This is a demonstration of how intensive the pollution minimization system is and how the treatment system is designed to ensure that minimal degradation will occur in the receiving waters for all parameters of concern.

The analysis conducted complies with the alternative analysis process described in Minnesota Rule 7050.0280 subpart 2, and 7052.0320 subparts 2 and 3. The MPCA finds that there are no prudent and feasible alternatives, including pollution prevention or alternative technology, to completely avoid degradation of downstream receiving waters. The combined water management and wastewater treatment system alternatives analysis described above complies with the requirements to identify alternatives for BCCs and BTPT. PolyMet selected the BTPT for its proposed treatment system.

Existing uses and the level of water quality necessary to protect existing and beneficial uses shall be maintained and protected

Minnesota rules require protection of existing uses and maintenance of the level of water quality necessary to protect those uses, Minn. R. 7050.0265 subp. 2; 7052.0300 subp. 2. To evaluate whether the discharge will reduce water quality or would remove an existing use, MPCA compared the available information describing the expected discharges from the selected pollution control alternative to the applicable water quality standards.

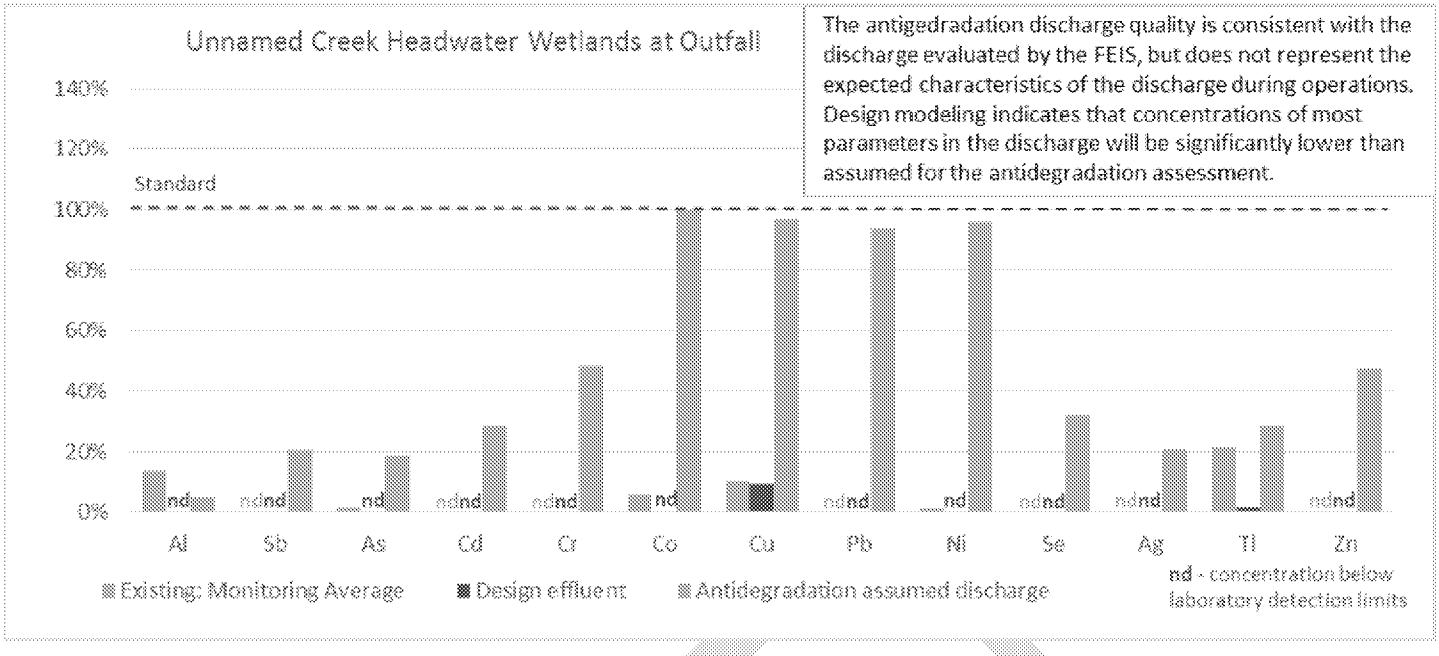
PolyMet conducted its antidegradation analysis using a set of projected effluent concentrations (Table 3-2 in section 3.1.1 of the antidegradation analysis). The concentrations in that Table 3-2 are taken from the FEIS except for several parameters (boron, chloride, pH, total dissolved solids, hardness and specific conductance) derived from design modeling completed since the FEIS. Table 3-1 of the antidegradation analysis shows the distinction between the FEIS concentrations and the design model concentrations.

The distinction between these two sets of projected effluent concentrations is important in understanding how designated uses will be protected with the projected discharge.

> FEIS concentrations: Project effluent quality (i.e., GoldSim results) used in the FEIS effects analysis.
>
> Design model concentrations: Projected effluent quality based on bench and pilot testing and on advanced engineering design modeling.

The FEIS concentrations are based on modeling required during the FEIS process and do not directly incorporate information obtained from a combination of testing at the bench and pilot scale and advanced wastewater modeling of the likely projected performance of the WWTP. The new information obtained through more recent advanced engineering design of the treatment system demonstrates that every parameter except for boron and chloride will be treated to equivalent or lower levels than assumed in the FEIS effects analysis. This conclusion is supported by the results of the "Plant Site Wastewater Treatment Plant Pilot Testing" report <[HYPERLINK "https://www.pca.state.mn.us/sites/default/files/Plant%20Site%20Wastewater%20Treatment%20Plant%20Pilot%20testing.pdf"]> and the "Wastewater Treatment System Design and Operation Report"<[HYPERLINK "https://www.pca.state.mn.us/sites/default/files/Waste%20Water%20Treatment%20System%20Design%20and%20Operation%20Report.pdf"]> submitted as part of the NPDES/SDS permit application. The MPCA considered both the FEIS concentrations and the design model concentrations when evaluating the antidegradation analysis.

The figure below provides a visual representation of the difference between the FEIS concentrations and the design model concentrations for selected parameters of concern (Figure 6-3 from Appendix A of Vol III – Waste Water Treatment System of the permit application). This figure shows that the design model concentrations of key parameters of interest are below the FEIS concentrations, are less than or comparable to existing monitoring averages and are mostly below the limits of detection.



The engineering design concentrations are less than the FEIS effects analysis concentrations for all parameters of concern except boron and chloride.

Design modeling estimated higher chloride concentrations than FEIS modeling result from different assumptions about chloride retention (*Note: the justification for this increase will be described in PolyMet's anticipated revision of the antidegradation review)*.

The most restrictive water quality standard applicable for boron is 500 µg/L in Class 4A waters, Minn. R. 7050.0224. The FEIS estimated discharge concentrations of 180 µg/l. Using the information from design modeling, boron is projected to be discharged at a concentration of 210 µg/L, which is in the range of ambient concentrations measured in the Second Creek and Unnamed Creek headwater segments (Table 1). In the Trimble Creek headwater wetlands, the 210 µg/L effluent concentration is 25 µg/L higher than the highest boron concentrations measured (Table 1). However, the minimal degradation of boron in the immediate receiving waters will not impact any designated use.

Table 1. Existing Boron concentrations in µg/L as measured at the Second Creek, Trimble Creek and Unnamed Creek headwaters.

Reach	Location	Sample Count	Min	Max	Average
Second Creek	PM-7	98	92	311	210
Trimble Creek	TC1-a	12	< 100	185	138
Unnamed Creek	PM-11	23	< 100	307	207

The most restrictive water quality standard for chloride is 230 mg/L in Class 2 waters. Based on the design modeling estimates, chloride is projected to be discharged at a concentration of 23.4 mg/L, which is in the range of ambient concentrations measured in the headwaters of Trimble Creek and Unnamed Creek (Table 2). In the Second Creek headwaters the 23.4 mg/L effluent concentration is 1.9 mg/L higher than the highest chloride concentrations measured (Table 2). The minimal degradation of chloride in the immediate receiving waters will not impact any designated use.

Table 2. Existing chloride concentrations in mg/L as measured at the Second Creek, Trimble Creek and Unnamed Creek headwaters.

Reach	Location	Sample Count	Min	Max	Average
Second Creek	PM-7	155	3.1	21.5	11.5
Trimble Creek	TC1-a	38	6.6	33.5	17.3
Unnamed Creek	PM-11	81	3.1	34.1	17

The antidegradation analysis conducted by PolyMet used the conservatively high effluent concentrations from the FEIS to ensure the antidegradation analysis was protective of all existing water quality standards and designated uses at these effluent concentrations; the analysis did not rely on the lower effluent concentrations that resulted from the subsequent engineering design modeling. All projected effluent concentrations will be below water quality standards based on both the concentrations from the FEIS effects analysis or the projected engineering design modeling concentrations.

The class 3 hardness standard and the class 4A sodium, bicarbonate, total dissolved solids and specific conductance water quality standards will all be met. See Minn. R. 7050.0223, 7050.0224. The proposed project would cut off movement of existing polluted groundwater. As a result, the headwaters of Second Creek, Trimble Creek and Unnamed Creek will experience a measurable improvement in water quality with regards to sulfate, salty parameters and mercury when treated effluent is discharged to those locations. Because the effluent will not cause an exceedance of any water quality standard, designated uses in the downstream receiving waters will be protected.

The only bioaccumulative chemical of concern as defined in Minnesota Rule 7052.0010, subparts 4 and 5, in the effluent is mercury. The net loading of mercury will be minimized because the effluent from the wastewater treatment system is expected to be below the applicable water quality standard of 1.3 ng/L. The receiving water wetlands and downstream creeks are not listed as impaired for mercury. Because the net mercury loading will decrease from current conditions in all receiving waters, all OIRW and ORVW downstream waters will be protected including Lake Superior.

The water quality necessary to preserve the exceptional characteristics of outstanding resource value waters shall be maintained and protected (Minn. R. 7050.0265 subp. 6) ensuring the tier 3 requirements of antidegradation are met.

Degradation of high water quality shall be minimized and allowed only to the extent necessary to accommodate important economic or social development

Existing water quality was determined using the methods in Minn. R. 7050.0260 (as described in Sections 6.2 and 8.2 of the antidegradation analysis) and the potential for a measurable change in water quality was assessed (Sections 6.3 and 8.3). The analysis compared projected effluent concentrations to average measured receiving water values, which is acceptable for this evaluation. For nearly all pollutants, no degradation is projected from the discharge. In the cases of boron and chloride, where a small negative measurable change (i.e., degradation) in water quality would occur, the degradation was minimized and allowed only to the extent necessary to accommodate important economic or social development (as described in Antidegradation Analysis Sections 7.4 and 9.3).

Sections 7.5 and 9.4 of the antidegradation analysis describe the social and economic changes expected from the project as required by rule. Minn. R. 7050.0265; 7052.0320 subp. 2. The social and economic analysis considers economic gains, contributions to social services, prevention or remediation of environmental or public threats, trade-offs between environmental media and the value of the water resources as required in Minn. R. 7050.0265 Subpart 5(b). The social and economic analysis uses the same reasoning and draws the same conclusions as those presented in the FEIS. The analysis appropriately demonstrates that the expected economic and social benefits of the project outweigh the

minimal degradation in receiving water quality that will occur. Upon review of the social and economic analysis, MPCA has determined that the projected degradation in water quality is necessary to accommodate the important economic and social development aspects of the project.

Protection against impairments associated with thermal discharges

The treatment process will add minimal heat to the water and will be approximately the same temperature of shallow groundwater. No thermal impacts are expected.

Conclusion

The preliminary determination of the MPCA is that the antidegradation analysis submitted by PolyMet as part of its NPDES/SDS permit application is fully compliant with Minnesota Rule 7050.0265, Minnesota Rule 7052.0300, and federal surface water pollution control statutes and rules administered by the commissioner.

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